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High-resolution spatiotemporal salinity monitoring of saltwater intrusion dynamics in shallow aquifers of the Mekong Delta, Vietnam

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Process knowledge on the interaction between surface water and groundwater aquifers in coastal zones is of crucial importance in regions affected by rising sea water levels. In coastal regions uncontrolled extraction of groundwater for drinking water supplies and/or extensive agriculture is often followed by critical saltwater intrusion and subsequently affects the quality of valuable water resources. Additionally, sea level rise often has a similar impact on groundwater quality. A hot spot of this environmentally critical scenario are the coastal regions of the Mekong-Delta, which is extensively exploited for agriculture (particularly rice and shrimp farming). A strong population growth adds additional pressure on groundwater resources. Besides a very critical outlook in terms of climate change large areas along the coast line suffer already on saltwater intrusion in shallow aquifers, which are prone to become completely unusable.

To get a deeper understanding of the impacts of upstream developments and other external effects on saltwater intrusion in the Mekong Delta, two test sites at Tra Vinh city (140 km SW of Ho Chi Minh city) were chosen for multiple water quality measurements in rivers, channels and shallow groundwater wells. Observation wells were specially equipped for high-resolution spatiotemporal salinity monitoring. In this process electric conductivity is monitored at multiple depths to identify the mechanisms of groundwater regeneration and exchange with the surface waters. To assess signals and trends of the salinity special conductivity measurement chains were developed and combined with modern telemetric data transfer.

The results of the monitoring campaign show that the vertical, spatial and temporal variation of salinity in the groundwater is much higher than anticipated. This opens the path towards an adapted groundwater use and management, even possibly enabling the use of the assumed saline shallow aquifer for irrigation during particular phases of the dry season. Generally, the findings emphasize that better high-resolution monitoring technologies play a key role in the assessment and water management measures.